

The Effectiveness of PT Pertamina Patra Niaga Fuel Terminal Ternate's CSR Program in Improving Traditional Fishermen Welfare in Ternate

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Abstract. Fish Aggregating Devices (FADs) are artificial structures that aid fishermen in catching fish using traditional methods. However, conventional FADs are often made from materials that do not break down easily, which can harm marine ecosystems by creating long-lasting debris. This study examines the Pena Laut program, which aims to support traditional fishermen while protecting the marine environment. Specifically, the research assesses the effectiveness of Corporate Social Responsibility (CSR) initiatives and new, eco-friendly fishing gear in Ternate waters. Using documentation and observation, the study sampled 18 program beneficiaries and applied a qualitative descriptive method. Community Satisfaction Index (CSI) data were collected through surveys. The findings reveal that the CSR program from PT Pertamina Fuel Terminal Ternate has had a positive impact on the welfare of fishermen. Activities in the program include forming fishing groups, installing infrastructure, providing cooperative training, and producing eco-friendly products. The survey indicates that the program is operating effectively, with an CSI score of 3.77, or 94.19% when converted, which is considered very good. To ensure continued productivity and sustainability, a new portable, environmentally friendly FAD was developed. This innovation has enabled fishermen to increase their catches, resulting in a 30% rise in community income, equivalent to approximately IDR 150,000 per month, an increase from IDR 500,000 to IDR 650,000.

Keywords: Effectiveness, Program, CSR, CSI, eFAD Innovation.

A. INTRODUCTION

Ternate City ranks among the leading producers of marine capture fisheries in North Maluku Province. According to Statistics Indonesia (BPS), in 2022, Ternate City's total capture fish production reached 48,234 tons, with an estimated market value of IDR 1,057,700,342 (Indonesian Rupiah). For context, BPS data for Ternate City (2025) show the city comprises 8 districts and 78 villages, several of which, such as Jambula Village, border the ocean; Jambula serves as the capital of Ternate Island District.

The majority of Jambula Village residents are fishermen, which enables the village to contribute significantly to Ternate City's capture fisheries production. In 2022, the Directorate of Capture Fisheries of the Ministry of Maritime Affairs and Fisheries (Kementerian Kelautandan Perikanan or KKP) issued Decree Number 59, designating Jambula Village as an Advanced Fishermen's Village. This status was granted because Jambula Village fulfilled the location requirements outlined in Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 34 of 2022 concerning Advanced Fishermen's Villages. Approximately 70% of the Jambula Village population is engaged in fishing (Andriani et al., 2024). These geographic and social factors position Jambula Village as a key area for marine and fisheries sector development.

Most fishermen in Jambula Village are traditional fishermen who utilize simple, manual fishing technology, generally limited to coastal areas (Solihin & Wahidhani, 2024). Challenges include reliance on conventional fishing gear, inadequate infrastructure, and restricted access to economic institutions. Traditional equipment such as handlines, basic nets, and small boats

is affordable and easily operated, often relying on inherited experience (Saputra et al., 2024; Solihin & Wahidhani, 2024). These constraints significantly impact the community's economic status: fishermen without access to advanced gear and fleets often have low income, poor quality of life, and limited social welfare, remaining subsistence-oriented (Saputra et al., 2024). Quantitative data show that the average income of Jambula fishermen before program intervention was approximately IDR 500,000 per month (CSR Implementation Report 2024), which is below the North Maluku Province poverty line of IDR 604,460 per capita per month in 2024 (BPS, 2024). This situation shows that limited access to modern fishing gear directly contributes to low economic and social welfare among conventional fishermen.

The quality of life among Jambula fishermen remains low. Most income is allocated to basic necessities such as food, fuel, and equipment, leaving minimal resources for savings or secondary needs. Fishermen's households typically reside in modest dwellings with limited sanitation and restricted access to services, including healthcare and transportation. The majority of fishermen possess only elementary education or none at all, which limits opportunities for alternative employment outside the fishing sector. This aligns with findings by Hidayati et al. (2021), who note that the motivation to complete formal education is low in several Indonesian regions, and many fishing families do not view formal education as a pathway to employment outside the sector. Subsistence fishing persists, with daily catches sold to middlemen at low margins, preventing economic reserve accumulation (Elanda & Azizah Alie, 2020). Fishing gear remains rudimentary, and there is continued reliance on illegal fish aggregating devices (FADs) with limited range. FADs are considered illegal if installation does not comply with regulatory requirements. Ministerial Regulation Number 36 of 2023 stipulates that FADs must have permits, be placed outside measured fishing zones or designated areas, and not violate technical specifications. Research by Limatahu et al. (2024) in Rua Village, Ternate City, found that many fishermen lack permits, place FADs too close together, and fail to provide required identification. These patterns indicate that traditional fishing in Jambula prioritizes survival over sustainable business development.

FADs are widely utilized by traditional fishermen in Jambula Village. FADs consist of floating components anchored to the seabed and are used to attract pelagic fish such as tuna, thereby increasing fishing efficiency (Valles, 2023). However, most FADs in use are constructed from materials that are environmentally unfriendly and slow to decompose, including bamboo, used tires, plastic rope, plastic drums, and Styrofoam. Abandoned or discarded FADs contribute to marine pollution and can damage coral reefs and associated ecosystems (Escalle et al., 2019). Sudarma (2023) notes that polypropylene and polyamide plastics, commonly used in fishing gear, require 100 to 500 years to decompose, while synthetic rubber from used tires may take over 2,000 years. In contrast, organic materials like bamboo decompose within 1 to 3 years in tropical marine environments. Consequently, FAD waste has emerged as a significant environmental issue requiring urgent attention.

PT Pertamina Patra Niaga Fuel Terminal Ternate has implemented a Community Empowerment program as part of its Corporate Social Responsibility (CSR) initiatives to support the development of coastal communities, particularly within its operational Ring 1 area. This CSR program aims to empower fishermen in Jambula Village across the entire value chain, enhancing productivity and promoting sustainable marine fishing practices. The objective of this study is to assess the effectiveness of PT Pertamina Patra Niaga Fuel Terminal Ternate's CSR program in improving the welfare of traditional fishermen while ensuring the sustainability of the marine ecosystem along the Ternate Coast, North Maluku.

B. METHOD

The research was conducted in Jambula Village, Pulau Ternate District, Ternate City, North Maluku Province. The study focused on PT Pertamina Patra Niaga Fuel Terminal Ternate as the subject, with the implementation of the "Strengthening Fishermen to Sustain the Sea (Pena Laut)" CSR program as the object. A descriptive qualitative method was employed. Data sources included both primary and secondary data. Primary data were collected through field observations, interviews, and surveys, while secondary data were obtained from literature studies using reliable and relevant sources. The sample was selected purposively, targeting active fishermen who directly benefit from the CSR program. As a result, 18 fishermen from the Marimoi Jaya Fishermen Group were included in the study. Program success in terms of beneficiary satisfaction was evaluated to determine whether the goals and expectations of both beneficiaries and stakeholders were achieved. Indeks Kepuasan Masyarakat (IKM) or The Community Satisfaction Index (CSI) was measured using quantitative methods, specifically through surveys administered to program beneficiaries. The survey assessed aspects such as planning, implementation, benefits, and monitoring and evaluation.

C. RESULTS AND DISCUSSION

1. Implementation of the "Strengthening Fishermen to Preserve the Sea (Perkuat Nelayan Lestarian Laut or Pena Laut) Program

The Pena Laut Program was created as a social contribution of PT Pertamina Patra Niaga Fuel Terminal Ternate to support the capacity building of fishermen in the company's Ring 1 operational area. This program strengthens the identity of the Advanced Fishermen's Village as established by KKP (through Decree No. 59 from the Directorate of Capture Fisheries, with a community-based empowerment approach, strengthening cooperative institutions, and preserving the marine environment. With a sustainability concept that emphasizes increasing fish catches without harming the environment, as well as utilizing marine waste to create innovative economic products, it is hoped that this approach can improve social conditions for the community. Alim et al. (2022) stated that community empowerment programs implemented in stages and sustainably are expected to be able to raise the standard of living of the assisted community as the target objective to be more prosperous, empowered, able to meet basic living needs, and encourage the creation of sustainable independence.

The Pena Laut Program mainly focuses on two areas: providing facilities for fishermen groups and offering training in marine fishing and financial management for fishermen cooperatives. Before starting these activities, the program first held sessions to inform and strengthen the commitment of fishermen in the Ring 1 area. These sessions explained the program's goals, what was needed, and the roles of everyone involved, helping to create a work plan for the following year. Nuryana et al. (2025) explained that these sessions are not just for sharing information, but also for encouraging open discussion and building a shared commitment between the program team and the community.



Figure 1. Socialization and Strengthening of Commitment of Ring 1 Fishermen

Source: CSR Documentation of PT Pertamina Patra Niaga FT Ternate (2025)

The subsequent sub-chapters provide detailed explanations of each activity. *The first activity*, involved providing facilities for fishermen's groups to improve their welfare by strengthening infrastructure. The supporting facilities included the procurement and installation of five solar-powered street lights in the Jambula Beach area and the construction and equipping of a small fishing boat workshop.

Effective infrastructure provision can facilitate fishing activities for fishermen. The installation of solar-powered lights helps illuminate the Jambula coastal road, making it easier for fishermen to navigate at night. The construction of a fishing boat repair shop can help reduce the costs incurred by fishermen in repairing damaged boats. Furthermore, the existing workshop in Jambula Village also has limited equipment, which creates a problem when severely damaged boats cannot be repaired there, and fishermen must travel considerable distances to more equipped workshops in the city. The construction of this workshop enables fishermen to access boat repairs more easily. N'Souvi et al. (2025) stated that the provision of fishing facilities, infrastructure, and access to adequate technical guidance, as well as fostering a sense of mutual cooperation through fisheries associations and cooperatives, has been proven to significantly increase fishermen's productivity.



Figure 2. Installation of Solar Panel Lights

Source: CSR Documentation of PT Pertamina Patra Niaga FT Ternate (2025)

The second activity, it is training on sustainable marine fishing and financial management for fishermen's cooperatives. The objective of this activity is to strengthen the capacity of fishermen's groups in managing environmentally friendly and sustainable fishing

businesses, encourage the formation of strong and independent fishermen's cooperative institutions, and improve fishermen's welfare through the development of the blue economy. The blue economy is an economic development concept that focuses on the sustainable use of aquatic and marine resources. The blue economy seeks to enhance economic growth by harnessing the economic potential of the marine and fisheries sector, while preserving marine ecosystems and ensuring that marine resources are utilized sustainably (Nansi et al., 2024). This concept is implemented by PT Pertamina FT Ternate through mentoring activities for the formation of fishermen's cooperatives from active cooperative members, including institutional and management training, blue economy capacity building training, covering fishing efficiency, catch utilization, and marine conservation, as well as training and facilitation in the production of eco-products from marine waste (plastic, used nets, etc.).

Community capacity-building initiatives have been shown to enhance resident productivity and improve social cohesion. Training in the use of portable FADs has led to increased fish catches among fishermen by enabling more efficient fishing practices. This outcome is consistent with findings by Wudianto et al. (2019), who demonstrated the effectiveness of portable FADs for harvesting tuna and skipjack tuna. In addition, institutional strengthening activities targeting fishermen's cooperatives have been implemented to improve both the capabilities and economic outcomes of fishermen. Comprehensive training on cooperative principles was provided to increase awareness and build foundational knowledge in cooperative financial and business management. Following this training, members of fishermen's groups demonstrated improved understanding and application of cooperative financial management, including effective maintenance of cooperative cash bookkeeping. Knowledge transfer among fishermen further contributed to the stability and growth of cooperative-based fishing group enterprises. Solomon (2023) identified fishermen's cooperatives as optimal organizations for enhancing the socioeconomic status of small-scale fishing communities. Cooperatives play a critical role in addressing economic challenges, supporting sustainable development goals, generating income, and providing employment and alternative livelihoods through small and medium enterprises.

Waste management training is delivered to communities to develop innovative economic skills in marine resource management. The training addresses waste generated from both fishing and non-fishing activities that contribute to environmental pollution in marine and terrestrial settings. Transforming marine waste and fishery by-products into value-added products, such as organic fertilizer or raw materials for small-scale industries, presents new business opportunities for coastal populations. The limited availability of subsidized fertilizer and the high cost of non-subsidized alternatives have motivated communities to identify local solutions. For instance, Imanullah et al. (2024) documented the conversion of marine fish waste, including bycatch, into liquid organic fertilizer by women in South Hagu Village, Aceh.

These activities strengthen the economic resilience of fishing households and help mitigate overfishing. Waste management training increases community awareness of the ecological, social, and economic significance of marine conservation and encourages efforts to prevent environmental pollution. Mozumder et al. (2022) noted that fishery waste, including by-products from seafood processing, can create new employment opportunities and alternative sources of income for local communities, particularly fishermen. Such waste can be processed into fish meal for animal feed, organic fertilizer, and biodiesel. The impact of this training is especially significant in Ternate, where waste processing remains limited. Muhammad et al. (2024) found that 90% of Ternate residents dispose of waste in temporary sites, drainage systems, beaches, and gutters, a situation attributed to insufficient public education on waste management. Consequently, waste processing training under the Pena Laut

program enhances the efficient use of natural resources, reduces environmental pollution, and minimizes waste generation at its source.



Figure 3. Blue Economy Socialization



Figure 4. Marine Waste Management Training

Source: CSR Documentation of PT Pertamina Patra Niaga FT Ternate (2025)

2. Community Satisfaction Index towards the Program

Evaluation of the extent to which a program benefits the community is essential, as demonstrated by previous program experiences. The effectiveness of a CSR program can be assessed using the Community Satisfaction Index (CSI). Yuliani et al. (2023) define the CSI as data and information collected from a community satisfaction survey that measures satisfaction with specific activities. Satisfaction encompasses feelings of contentment, happiness, or disappointment based on the benefits received and expectations. Public satisfaction with program implementation is critical, as it directly influences public trust (Sigit, 2022). High-quality public services foster greater trust among community members. The delivery of quality public services is a key indicator of effective company performance in empowering the state apparatus. According to the Decree of the Minister of Administrative and Bureaucratic Reform No. 63 of 2003, the success of service delivery is determined by the satisfaction level of service recipients. Service satisfaction is achieved when community needs are effectively addressed. Consequently, periodic CSI surveys are recommended.

FT Ternate's CSR program is estimated to have provided significant benefits to the community. Therefore, it's only natural that the community targeted by the CSR program has been satisfied. The results of the Pena Laut program's CSI survey are explained in the following subsection:

3. Community Response to Program Planning Aspects

The following are the results of the CSI survey from the planning aspect of the Pena Laut program:

Table 1. Sea Pen Program Planning Index Values

Assessed Indicators	Index Value
Program planning is carried out by involving relevant multi-stakeholders (village government, etc.)	3.78
The proposed program plan is in accordance with my/the community's needs.	3.67
My aspirations/input regarding the program are always received/responded to/followed up by the company	3.89
I am always involved in the program planning process by the company/program facilitator.	3.72
For public knowledge of the goals and objectives to be achieved	3.78
Average	3.77

Source: Processed CSI Data, 2025

Survey results indicate that the index of involvement of relevant stakeholders in program planning is 3.78, categorized as very good. This suggests that FT Ternate has engaged multiple parties, including government representatives and local RT or RW leaders, in the program development process. The suitability of the proposed program plan with community needs received an index value of 3.67, also classified as very good. This demonstrates that the community perceives the program plan as aligned with the needs of groups in Jambula Village. The index value for the reception and follow-up of community aspirations or input by the company is 3.89, indicating that the company actively considers community feedback in program determination. Community involvement in the Pena Laut program planning process is reflected by an index value of 3.72, signifying that the community perceives meaningful participation in planning activities. Additionally, the index value for community knowledge of the program's goals and objectives is 3.78, indicating that the community is generally well informed about the intended outcomes of the program.

The community satisfaction survey for the Pena Laut program planning aspect yielded an average index of 3.77, categorized as very good. This result indicates a high level of community satisfaction with the program planning conducted by PT Pertamina FT Ternate. The findings suggest that the company demonstrates attentiveness and inclusivity in program preparation. Community involvement in program planning is recognized as a critical factor for program effectiveness. As noted by Nurozi and Sisdiyanto (2025), active community participation enhances program relevance, aligns benefits with local needs, and supports program sustainability. Furthermore, higher levels of participation during planning foster a sense of ownership, which can increase long-term commitment to the program. This aligns with Gantika's (2025) assertion that direct community involvement cultivates a strong sense of ownership, thereby promoting sustained engagement even after company intervention concludes.

4. Community Response to Program Implementation Aspects

Program implementation is carried out in accordance with existing plans. This process is carried out based on outputs and indicators that serve as benchmarks for program success. With these benchmarks, the program implementation process will be more focused and measurable. The following are the results of an SME survey on the implementation of the Pena Laut program:

Table 2. Implementation Index Value of the Sea Pen Program

Assessed Indicators	Index Value
My communication and coordination with the company/facilitator regarding the program	3.56
The program realization is in accordance with the needs in terms of type, form and quantity.	3.61
The program was implemented on time according to planning.	3.89
The program's beneficiaries are on target and according to plan.	3.72
Index value of group participation level in program implementation and activities	3.78
Average	3.71

Source: Processed CSI Data, 2025

The community survey for the Pena Laut program reported a communication and coordination index value of 3.56, categorized as very good. This result demonstrates highly effective communication and coordination between the group and the company. The index value for the alignment of program realization with group needs, evaluated by type, form, and quantity, was 3.60, also rated as very good. This finding indicates that PT Pertamina FT Ternate has successfully aligned its program with the needs of community groups. The index value for the timeliness of program implementation relative to planning was 3.89, showing that the program was executed according to the planned schedule. The suitability of realization with the target plan for program beneficiaries received an index value of 3.60, confirming that the program reached its intended targets. The index value for group participation in program implementation and activities was 3.78, reflecting strong engagement by group members in program activities.

Based on the results of a community satisfaction survey conducted by PT Pertamina FT Ternate regarding the implementation of the Pena Laut program, the average index value was 3.71 (very good). This index value indicates that community satisfaction with the implementation of PT Pertamina FT Ternate's social program is very good. Community groups truly feel that the program is running well, from assistance with facilities and infrastructure to increasing human resource capacity. Community satisfaction with program implementation has a positive impact in the form of increased community participation and support in program implementation (Hasibuan et al., 2025).

5. Community Response to the Benefit Aspects of the Program

Programs implemented by companies are expected to provide benefits to target groups/the wider community, both directly and indirectly. Benefits derived from the program can be implicit (e.g., skills, income, etc.) or explicit (e.g., access to healthcare, roads, etc.).

The following are the results of a survey of SMEs regarding the implementation of the Pena Laut program:

Table 3. Benefit Index Value of the Sea Pen Program

Assessed Indicators	Index Value
The program being implemented is able to increase my/the community's socio-economic independence	3.72
My/the community's abilities and skills have increased after the program	3.83
My/the community's knowledge increased after the program	3.89
My/the community's behavior, habits, conditions, or ways of doing things have become better after the program.	3.72
My/community income increased after the program	3.78
Average	3.79

Source: Processed CSI Data, 2025

Based on the results of the community satisfaction survey, it was found that the index value for the community's knowledge level indicator after the program was 3.89 (very good). This means that the group's knowledge has increased significantly after the social program. Then, the indicator for increasing community abilities and skills after the program had an index value of 3.83 (very good), which can be interpreted as meaning that, in addition to increasing knowledge, the group also experienced a significant increase in abilities and skills during the program implementation. The indicator for the group's behavior, habits, conditions, and ways of working to improve was at an index value of 3.72 (very good). This value indicates that the group felt there was an improvement in their behavior, habits, conditions, or ways of working towards a better direction after the program. The community's income level after the program showed an index value of 3.78 (very good). This means that the group assessed their income level as having increased relatively after the program from PT Pertamina FT Ternate. Furthermore, the index value for the program's benefits to increase the community's social and economic independence showed a figure of 3.72 (very good). This illustrates that, on average, group members perceived the program's benefits in terms of increased social and economic independence.

Based on a survey of community satisfaction with the benefits of the Pena Laut program, the average index value was 3.79 (very good). This index value indicates that the community is very satisfied with the benefits of PT Pertamina FT Ternate's social program. Based on program implementation and mentoring, the group assessed a positive increase in community capacity, knowledge, abilities, and income. According to Rosidi and Sumardjo (2020), one indicator of assessing the success of a CSR program is whether the program provides benefits that meet community needs and contributes to poverty alleviation.

6. Community Response to Program Monitoring and Evaluation Aspects

Evaluation activities are necessary to measure program performance, from planning to implementation, and its benefits to target groups. Program monitoring is conducted periodically to quickly identify challenges or obstacles encountered in program implementation and determine follow-up actions. The following are the results of a survey of SMEs regarding the implementation of the Pena Laut program:

Table 4. Monitoring and Evaluation Aspect Index Values of the Sea Pen Program

Assessed Indicators	Index Value
I am always involved in the program monitoring and evaluation process.	3.78
The company/facilitator always provides assistance and monitoring of the program	3.78
I always provide feedback for improvements to program development.	3.89
The company/facilitator carries out program evaluation activities periodically.	3.83
The company/facilitator always follows up on feedback for improvements to program development.	3.72
Average	3.80

Source: Processed CSI Data, 2025

Based on the results of the survey conducted, it can be seen that the index value for the community involvement indicator in the program monitoring and evaluation process is 3.78 (very good). This indicates that beneficiaries are always involved in the program monitoring and evaluation process. The indicator of program mentoring and monitoring by the company or facilitator has an index value of 3.78 (very good). This means that the company or facilitator is considered very active in mentoring and monitoring the program. The index value for active community involvement in providing input for program development improvements is 3.89 (very good). This can be interpreted as meaning that the community is highly active in providing input for program development improvements. The indicator of periodic program evaluation activities by the company/facilitator has an index value of 3.83 (very good), and the indicator of the company/facilitator always following up on input for improvements for future program development shows an index value of 3.72 (very good). The index value for both indicators can be interpreted as meaning that the group assesses that the company carries out program monitoring and evaluation activities well, and that the input for improvements submitted by the community for future program development is always followed up on well by the company/facilitator.

Based on a survey of community satisfaction with the monitoring and evaluation aspects of the FT Ternate Sea Pen Program, the average index value was 3.80 (very good). This index value indicates that the community is satisfied with the monitoring and evaluation aspects of the social program implemented by PT Pertamina FT Ternate. Community groups assessed that the program's monitoring and evaluation activities had been conducted effectively. Rosidi and Sumardjo (2020) stated that community participation in the monitoring and evaluation stage is important because feedback from the community can provide input for improving the implementation of subsequent projects. Furthermore, June (2024) stated that community satisfaction with the program's evaluation aspects can be interpreted as an indication of the company's continued efforts to address the challenges faced by the community and its beneficiaries.

The final score for the CSI for PT Pertamina FT Ternate's Pena Laut program is determined based on the survey results described above. The results are presented in the following table.

Table 5. Final Results of the Community Satisfaction Index Assessment of the Pena Laut Program

Aspect	Index Value	Predicate
Public Satisfaction with Planning	3.77	Very good
Public Satisfaction with Implementation	3.71	Very good
Community Satisfaction with Benefits	3.79	Very good
Public Satisfaction with Monitoring and Evaluation	3.80	Very good
Average	3.77	Very good

Source: Processed CSI Data, 2025

The table above shows that the Pena Laut program of PT Pertamina FT Ternate achieved a CSI value of 3.77, classified as very good. This outcome demonstrates that the community is generally satisfied with the program, including its planning, implementation, benefits, and monitoring and evaluation components. According to Sigit (2022), an index value between 3.5324 and 4.00 is considered very good, indicating that the program has been implemented successfully. The monitoring and evaluation aspect received the highest index value at 3.80, while the implementation aspect received the lowest at 3.71. These findings suggest that monitoring and evaluation activities have been conducted effectively and are well received by the community. Although implementation activities are proceeding well, further improvements are necessary to address existing shortcomings and enhance program execution.

The high CSI value of the Pena Laut Program reflects its successful implementation. To ensure continued sustainability and productivity, the introduction of program innovations is essential. Khayubi et al. (2024) emphasize that following the successful implementation of a corporate social responsibility program, social innovation initiatives are required to sustain the program and enhance community productivity. Ministerial Regulation No. 1 of 2021 defines program innovation as a community empowerment activity that offers improved solutions to social problems or needs, ultimately strengthening community capabilities, cohesiveness, and resource utilization.

7. CSR Program Innovation

Innovation is integrated into community empowerment programs to ensure their sustainability and productivity. According to Ministerial Regulation No. 1 of 2021, key criteria for program innovation include novelty, enhancement of community capacity and independence, sustainability, and positive environmental and social impacts. Nurhadi et al. (2024) demonstrated that social innovation programs can have a positive impact on both society and the environment while advancing corporate sustainability objectives.

PT Pertamina Patra Niaga Fuel Terminal Ternate has introduced an innovation that strengthens the use of sound sonar methods to optimize marine fish catches. This approach addresses the challenge of suboptimal fish yields, particularly for tuna, a highly demanded commodity in North Maluku. Fishermen in Jambula Village continue to use conventional fishing gear and FADs, such as plastic FADs deployed in open waters, which are less effective in meeting fish supply requirements. Rumpa et al. (2025) noted that conventional FADs often result in the capture of non-target bycatch species. The catch typically consists of tuna species, including yellowfin and bigeye tuna, as well as small or juvenile skipjack tuna with immature gonads. Wudianto et al. (2019) further observed that persistent harvesting of juvenile tuna can negatively affect the sustainability of tuna fisheries.

Furthermore, another impact of conventional FADs is marine debris from discarded FADs. Valles (2023) stated that FADs released into the sea have the potential to become marine debris because they are not only washed away by the waves, but also because FADs that have

been submerged in the sea for a year will be damaged, and some fishermen are reluctant to retrieve them. If so, then fishermen will have to spend money again to make new FADs. This is explained by Bidayani et al. (2022), who note that conventional FADs are quite expensive to manufacture and must be placed in the water, making them difficult to move. In contrast, portable FADs can be moved to a desired location or stored for use in the next fishing activity. The innovation in the use of FADs aims to maximize tuna catches, reduce marine debris, and lower the costs associated with the manufacture of conventional FADs.

The Marimoi Jaya Fishermen's Group collaborated with Digitani IPB to apply the portable fish aggregating device, eFAD. The eFAD is an innovative fishing aid developed by IPB researchers to improve fisheries efficiency and sustainability. Unlike conventional FADs, which rely on physical attractants such as coconut leaves, bamboo, and weights, the eFAD employs an acoustic method by emitting sounds at specific frequencies to attract fish to a single location. The eFAD is generally shaped like a suitcase, featuring a speaker, lithium battery, and signal controller, making it portable, easy to carry, and convenient to operate in various fishing locations. Research conducted by Yusfiandayani et al. (2022) showed that the use of eFAD on handlines can influence the species composition of the catch and increase fishing efficiency, although productivity is not always higher than without FADs. Another study in Banten waters conducted by Simbolon et al. (2023) also confirmed that portable FADs can improve the effectiveness of small-scale fishing while reducing reliance on physical attractants that have the potential to become marine waste.

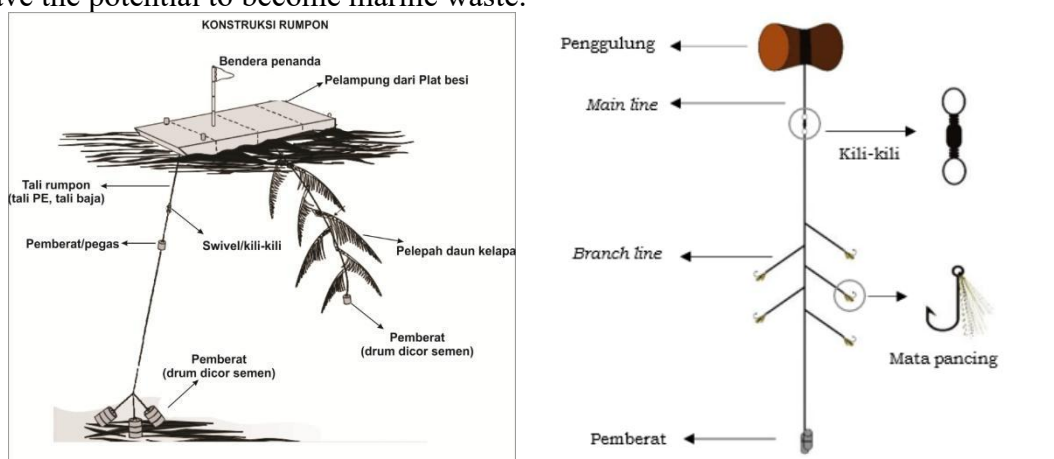


Figure 5. Conventional Fish Aggregating Devices

Source: Yusfiandayani, et al. (2020)

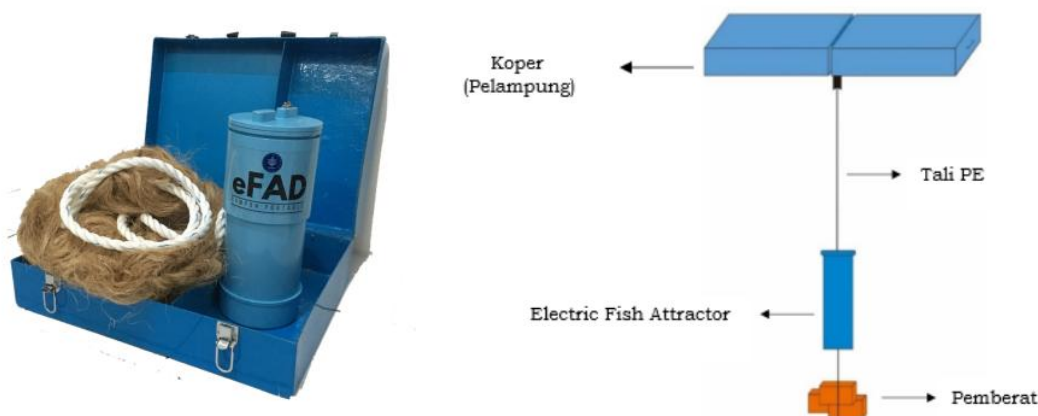


Figure 6. eFAD, Portable Fish Aggregating Device

Source: Yusfiandayani, et al. (2020)

Fishermen experience positive impacts from the use of eFAD, including increased productivity, reduced marine debris, and a contribution to marine ecosystem preservation. Through the Pena Laut CSR program, members of the Marimoi Jaya fishing group can gain additional knowledge and supplement their daily income through sea fishing. Evaluation results show that the average monthly income of fishermen increased from approximately IDR 500,000 to IDR 650,000, representing a 30% rise. Furthermore, they now understand and are more aware of the importance of preserving marine ecosystems from upstream to downstream, which impacts the tuna fish supply.

The Pena Laut program has not only increased the income of Jambula fishermen but has also had a significant impact on their social dynamics. Since the program's implementation, interactions among fishermen have intensified through cooperative activities and discussion forums, which have fostered stronger solidarity and collaboration in managing shared resources such as environmentally friendly FADs. Enhanced knowledge and skills have increased fishermen's confidence in self-organization, and participants are now more willing to share their expertise with other fishermen and groups. These outcomes indicate that, beyond economic benefits, the program has strengthened social cohesion, reduced reliance on intermediaries, and promoted more sustainable collective independence.

D. CONCLUSION

Based on the results and discussion of the research conducted, it can be seen that the Pena Laut program of PT Pertamina FT Ternate has had a positive and effective impact on the welfare of the people of Jambula Village. Activities carried out in this program include providing facilities for fishing groups and offering training to enhance the capacity of fishing group members. Based on the results of the CSI, it is known that the Pena Laut program has been well received by the community. Furthermore, innovation was carried out using eFAD to maintain the sustainability and productivity of the program. The use of eFAD helps fishermen catch fish more efficiently, resulting in a significant increase in their daily income. Finally, the Pena Laut program with the innovation of eFAD can improve the economy and welfare of traditional fishermen while maintaining the sustainability of the marine ecosystem on the Ternate Coast, North Maluku.

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